CLAIMS

1. A method of analyzing dioxins by laser ionization mass spectrometry using supersonic jet/resonance-enhanced multiphoton ionization, the method comprising:

the first step of obtaining respective specific wavelength spectra of a plurality of dioxin isomers whose concentrations are known, selecting a plurality of specific wavelengths from each of the specific wavelength spectra, and preparing calibration curves, each showing the relationship between the ion signal intensity and the dioxin isomer concentration at any one of the selected specific wavelengths, for all the specific wavelengths selected for each dioxin isomer;

the second step of preparing a sensitivity matrix showing the relationship between the ion signal intensities and the dioxin isomer concentrations at the specific wavelengths, from the calibration curves of the dioxin isomers prepared in the first step; and

the third step of obtaining a specific wavelength spectrum of a sample to be analyzed, and determining the concentrations of a plurality of dioxin isomers in the sample using the ion signal intensities of the specific wavelength spectrum of the sample and the sensitivity matrix prepared in the second step.

2. The method according to Claim 1, wherein the second step includes the sub-step of identifying dioxin isomers contained in the sample, and the sensitivity matrix is prepared according to the calibration curves of the dioxin isomers identified in the sub-step.

3. The method according to Claim 1, wherein the sensitivity matrix is prepared according to all the calibration curves prepared in the first step.

4. The method according to Claim 1, wherein the specific wavelength spectra are obtained in the first step by repeating the sequence of exciting the dioxin isomers with a first laser light having a first wavelength, ionizing the excited dioxin isomers with a second laser light having a second wavelength, and measuring the intensities of ion signals, while the first wavelength of the first laser light is varied step by step, and wherein the plurality of specific wavelengths are selected from each specific wavelength spectrum according to the following (1) to (14):

(1) for a dioxin isomer 2,3,7,8-TeCDD (tetrachlorodibenzo-para-dioxin), at least one specific wavelength is selected from the group consisting of 310.99 nm, 310.15 nm, 309.27 nm, 308.51 nm, 307.80 nm, 306.95 nm, 305.95 nm, 305.35 nm, and 305.11 nm;

(2) for a dioxin isomer 1,2,3,7,8-PeCDD

(pentachlorodibenzo-para-dioxin), at least one specific wavelength is selected from the group consisting of 312.79 nm, 312.62 nm, 312.45 nm, 312.28 nm, 312.12 nm, 311.62 nm, 311.46 nm, 311.36 nm, 311.15 nm, and 311.03 nm;

(3) for a dioxin isomer 1,2,3,4,7,8-HxCDD (hexachlorodibenzo-para-dioxin), at least one specific wavelength is selected from the group consisting of 314.81 nm, 314.59 nm, 314.48 nm, 314.19 nm, 314.10 nm, 313.79 nm, 313.64 nm, 313.54 nm, 313.48 nm, 313.23 nm, and 313.01 nm;

(4) for a dioxin isomer 1,2,3,6,7,8-HxCDD (hexachlorodibenzo-para-dioxin), at least one specific wavelength is selected from the group consisting of 313.82 nm, 313.67 nm, 313.60 nm, 313.52 nm, 313.40 nm, 313.27 nm, 313.21 nm, 313.16 nm, 313.10 nm, and 313.03 nm;

(5) for a dioxin isomer 1,2,3,7,8,9-HxCDD (hexachlorodibenzo-para-dioxin), at least one specific wavelength is selected from the group consisting of 315.01 nm, 314.80 nm, 314.62 nm, 314.23 nm, 313.72 nm, 313.44 nm, 313.34 nm, and 313.22 nm;

(6) for a dioxin isomer 2,3,7,8-TeCDF (tetrachlorodibenzofuran), at least one specific wavelength is selected from the group consisting of 319.45 nm, 318.27 nm, 316.20 nm, 315.35 nm, 314.56 nm, 313.96 nm, 312.98 nm, 311.79 nm, 311.68 nm, 311.07 nm, and 310.75 nm;

(7) for a dioxin isomer 2,3,4,7,8-PeCDF

(pentachlorodibenzofuran), at least one specific wavelength is selected from the group consisting of 314.91 nm and 315.83 nm;

(8) for a dioxin isomer 1,2,3,7,8-PeCDF (pentachlorodibenzofuran), at least one specific wavelength is selected from the group consisting of 315.17 nm and 316.14 nm;

(9) for a dioxin isomer 1,2,3,4,7,8-HxCDF (hexachlorodibenzofuran), at least one specific wavelength is selected from the group consisting of 320.49 nm, 319.94 nm, 319.68 nm, 319.04 nm, 318.11 nm, 317.63 nm, 317.28 nm, 316.97 nm, 316.81 nm, and 316.36 nm;

(10) for a dioxin isomer 1,2,3,6,7,8-HxCDF (hexachlorodibenzofuran), at least one specific wavelength is selected from the group consisting of 319.32 nm, 319.15 nm, 318.92 nm, 318.75 nm, 318.64 nm, 318.47 nm, 318.16 nm, 317.75 nm, 317.54 nm, 316.80 nm, 316.74 nm, and 316.45 nm;

(11) for a dioxin isomer 2,3,4,6,7,8-HxCDF (hexachlorodibenzofuran), at least one specific wavelength is selected from the group consisting of 322.77 nm, 321.03 nm, 320.42 nm, 319.21 nm, 318.75 nm, and 317.76 nm;

(12) for a dioxin isomer 1,2,3,7,8,9-HxCDF (hexachlorodibenzofuran), at least one specific wavelength is selected from the group consisting of 323.44 nm, 322.71 nm, 320.19 nm, 317.03 nm, and 316.55 nm;

(13) for a dioxin isomer 1,2,3,4,7,8,9-HpCDF (heptachlorodibenzofuran), at least one specific wavelength is selected from the group consisting of 324.18 nm, 323.34 nm, 322.87 nm, 322.71 nm, 322.49 nm, 321.81 nm, 321.30 nm, 319.56 nm, 319.17 nm, and 318.97 nm; and

(14) for a dioxin isomer 1,2,3,4,6,7,8-HpCDF (heptachlorodibenzofuran), at least one specific wavelength is selected from the group consisting of 324.51 nm, 323.80 nm, 323.41 nm, 323.21 nm, 322.64 nm, 322.11 nm, 321.91 nm, 321.56 nm, 321.43 nm, and 321.33 nm.

5. A method of analyzing dioxins which identifies a dioxin isomer from a specific wavelength spectrum obtained by laser ionization mass spectrometry using supersonic jet/resonance-enhanced multiphoton ionization, the method comprising:

the first step of obtaining a specific wavelength spectrum of a sample by repeating the sequence of exciting the sample with a first laser light having a first wavelength, ionizing the excited sample with a second laser light having a second wavelength, and measuring the intensity of ion signals, while the first wavelength of the first laser light is varied step by step; and

the second step of identifying 2,3,7,8-TeCDD (tetrachlorodibenzo-para-dioxin) contained in the sample from the specific wavelength spectrum of the sample obtained

in the first step and specific wavelengths of 2,3,7,8-TeCDD (tetrachlorodibenzo-para-dioxin) obtained in advance, by selecting at least two specific wavelengths from the specific wavelengths of 2,3,7,8-TeCDD (tetrachlorodibenzo-para-dioxin) shown in Table 1 and determining whether the selected specific wavelengths are shown in the specific wavelength spectrum of the sample obtained in the first step:

Table 1

2,3,7,8-TeCDD (tetrachlorodibenzo-para-dioxin)	
	Specific wavelength (nm)
1	310.99
2	310.15
3	309.27
4	308.51
5	307.80
6	306.95
7	305.95
8	305.35
9	305.11

6. A method of analyzing dioxins which identifies a dioxin isomer from a specific wavelength spectrum obtained by laser ionization mass spectrometry using supersonic jet/resonance-enhanced multiphoton ionization, the method comprising:

the first step of obtaining a specific wavelength spectrum of a sample by repeating the sequence of exciting the sample with a first laser light having a first wavelength, ionizing the excited sample with a second laser light having a second wavelength, and measuring the intensity of ion signals, while the first wavelength of the first laser light is varied step by step; and

the second step of identifying 1,2,3,7,8-PeCDD (pentachlorodibenzo-para-dioxin) contained in the sample from the specific wavelength spectrum of the sample obtained in the first step and specific wavelengths of 1,2,3,7,8-PeCDD (pentachlorodibenzo-para-dioxin) obtained in advance, by selecting at least two specific wavelengths from the specific wavelengths of 1,2,3,7,8-PeCDD (pentachlorodibenzo-para-dioxin) shown in Table 2 and determining whether the selected specific wavelengths are shown in the specific wavelength spectrum of the sample obtained in the first step:

Table 2

1,2,3,7,8-PeCDD (pentachlorodibenzo-para-dioxin)	
	Specific wavelength (nm)
1	312.79
2	312.62
3	312.45
4	312.28
5	312.12
6	311.62
7	311.46
8	311.36
9	311.15
10	311.03

7. A method of analyzing dioxins which identifies a dioxin isomer from a specific wavelength spectrum obtained by laser ionization mass spectrometry using supersonic jet/resonance-enhanced multiphoton ionization, the method comprising:

the first step of obtaining a specific wavelength spectrum of a sample by repeating the sequence of exciting the sample with a first laser light having a first wavelength, ionizing the excited sample with a second laser light having a second wavelength, and measuring the intensity of ion signals, while the first wavelength of the first laser light is varied step by step; and

the second step of identifying 1,2,3,4,7,8-HxCDD (hexachlorodibenzo-para-dioxin) contained in the sample from the specific wavelength spectrum of the sample obtained in the first step and specific wavelengths of 1,2,3,4,7,8-HxCDD (hexachlorodibenzo-para-dioxin) obtained in advance, by selecting at least two specific wavelengths from the specific wavelengths of 1,2,3,4,7,8-HxCDD (hexachlorodibenzo-para-dioxin) shown in Table 2 and determining whether the selected specific wavelengths are shown in the specific wavelength spectrum of the sample obtained in the first step:

Table 3

1,2,3,4,7,8-HxCDD (hexachlorodibenzo-para-dioxin)	
	Specific wavelength (nm)
1	314.81
2	314.59
3	314.48
4	314.19
5	314.10
6	313.79
7	313.64
8	313.54
9	313.48
10	313.23
11	313.01

8. A method of analyzing dioxins which identifies a

dioxin isomer from a specific wavelength spectrum obtained by laser ionization mass spectrometry using supersonic jet/resonance-enhanced multiphoton ionization, the method comprising:

the first step of obtaining a specific wavelength spectrum of a sample by repeating the sequence of exciting the sample with a first laser light having a first wavelength, ionizing the excited sample with a second laser light having a second wavelength, and measuring the intensity of ion signals, while the first wavelength of the first laser light is varied step by step; and

the second step of identifying 1,2,3,6,7,8-HxCDD (hexachlorodibenzo-para-dioxin) contained in the sample from the specific wavelength spectrum of the sample obtained in the first step and specific wavelengths of 1,2,3,6,7,8-HxCDD (hexachlorodibenzo-para-dioxin) obtained in advance, by selecting at least two specific wavelengths from the specific wavelengths of 1,2,3,6,7,8-HxCDD (hexachlorodibenzo-para-dioxin) shown in Table 2 and determining whether the selected specific wavelengths are shown in the specific wavelength spectrum of the sample obtained in the first step:

Table 4

1,2,3,6,7,8-HxCDD (hexachlorodibenzo-para-dioxin)	
	Specific wavelength (nm)
1	313.82
2	313.67
3	313.60
4	313.52
5	313.40
6	313.27
7	313.21
8	313.16
9	313.10
10	313.03

9. A method of analyzing dioxins which identifies a dioxin isomer from a specific wavelength spectrum obtained by laser ionization mass spectrometry using supersonic jet/resonance-enhanced multiphoton ionization, the method comprising:

the first step of obtaining a specific wavelength spectrum of a sample by repeating the sequence of exciting the sample with a first laser light having a first wavelength, ionizing the excited sample with a second laser light having a second wavelength, and measuring the intensity of ion signals, while the first wavelength of the first laser light is varied step by step; and

the second step of identifying 1,2,3,7,8,9-HxCDD (hexachlorodibenzo-para-dioxin) contained in the sample from the specific wavelength spectrum of the sample obtained in the first step and specific wavelengths of 1,2,3,7,8,9-HxCDD (hexachlorodibenzo-para-dioxin) obtained in advance, by selecting at least two specific wavelengths from the specific wavelengths of 1,2,3,7,8,9-HxCDD (hexachlorodibenzo-para-dioxin) shown in Table 2 and determining whether the selected specific wavelengths are shown in the specific wavelength spectrum of the sample obtained in the first step:

Table 5

1,2,3,7,8,9-HxCDD (hexachlorodibenzo-para-dioxin)	
	Specific wavelength (nm)
1	315.01
2	314.80
3	314.62
4	314.23
5	313.72
6	313.44
7	313.34
8	313.22

10. A method of analyzing dioxins which identifies a dioxin isomer from a specific wavelength spectrum obtained by laser ionization mass spectrometry using supersonic

jet/resonance-enhanced multiphoton ionization, the method comprising:

the first step of obtaining a specific wavelength spectrum of a sample by repeating the sequence of exciting the sample with a first laser light having a first wavelength, ionizing the excited sample with a second laser light having a second wavelength, and measuring the intensity of ion signals, while the first wavelength of the first laser light is varied step by step; and

the second step of identifying 2,3,7,8-TeCDF (tetrachlorodibenzofuran) contained in the sample from the specific wavelength spectrum of the sample obtained in the first step and specific wavelengths of 2,3,7,8-TeCDF (tetrachlorodibenzofuran) obtained in advance, by selecting at least two specific wavelengths from the specific wavelengths of 2,3,7,8-TeCDF (tetrachlorodibenzofuran) shown in Table 2 and determining whether the selected specific wavelengths are shown in the specific wavelength spectrum of the sample obtained in the first step:

Table 6

2,3,7,8-TeCDF (tetrachlorodibenzofuran)	
	Specific wavelength (nm)
1	319.45
2	318.27
3	316.20
4	315.35
5	314.56
6	313.96
7	312.98
8	311.79
9	311.68
10	311.07
11	310.75

11. A method of analyzing dioxins which identifies a dioxin isomer from a specific wavelength spectrum obtained by laser ionization mass spectrometry using supersonic jet/resonance-enhanced multiphoton ionization, the method comprising:

the first step of obtaining a specific wavelength spectrum of a sample by repeating the sequence of exciting the sample with a first laser light having a first wavelength, ionizing the excited sample with a second laser light having a second wavelength, and measuring the intensity of ion signals, while the first wavelength of the first laser light is varied step by step; and

the second step of identifying 2,3,4,7,8-PeCDF (pentachlorodibenzofuran) contained in the sample from the specific wavelength spectrum of the sample obtained in the first step and specific wavelengths of 2,3,4,7,8-PeCDF (pentachlorodibenzofuran) obtained in advance, by selecting at least two specific wavelengths from the specific wavelengths of 2,3,4,7,8-PeCDF (pentachlorodibenzofuran) shown in Table 2 and determining whether the selected specific wavelengths are shown in the specific wavelength spectrum of the sample obtained in the first step:

Table 7

2,3,4,7,8-PeCDF (pentachlorodibenzofuran)	
	Specific wavelength (nm)
1	315.83
2	314.91

12. A method of analyzing dioxins which identifies a dioxin isomer from a specific wavelength spectrum obtained by laser ionization mass spectrometry using supersonic jet/resonance-enhanced multiphoton ionization, the method comprising:

the first step of obtaining a specific wavelength spectrum of a sample by repeating the sequence of exciting the sample with a first laser light having a first wavelength, ionizing the excited sample with a second laser

light having a second wavelength, and measuring the intensity of ion signals, while the first wavelength of the first laser light is varied step by step; and

the second step of identifying 1,2,3,7,8-PeCDF (pentachlorodibenzofuran) contained in the sample from the specific wavelength spectrum of the sample obtained in the first step and specific wavelengths of 1,2,3,7,8-PeCDF (pentachlorodibenzofuran) obtained in advance, by selecting at least two specific wavelengths from the specific wavelengths of 1,2,3,7,8-PeCDF (pentachlorodibenzofuran) shown in Table 2 and determining whether the selected specific wavelengths are shown in the specific wavelength spectrum of the sample obtained in the first step:

Table 8

1,2,3,7,8-PeCDF (pentachlorodibenzofuran)	
	Specific wavelength (nm)
1	316.14
2	315.17

13. A method of analyzing dioxins which identifies a dioxin isomer from a specific wavelength spectrum obtained by laser ionization mass spectrometry using supersonic jet/resonance-enhanced multiphoton ionization, the method comprising:

the first step of obtaining a specific wavelength

spectrum of a sample by repeating the sequence of exciting the sample with a first laser light having a first wavelength, ionizing the excited sample with a second laser light having a second wavelength, and measuring the intensity of ion signals, while the first wavelength of the first laser light is varied step by step; and

the second step of identifying 1,2,3,4,7,8-HxCDF (hexachlorodibenzofuran) contained in the sample from the specific wavelength spectrum of the sample obtained in the first step and specific wavelengths of 1,2,3,4,7,8-HxCDF (hexachlorodibenzofuran) obtained in advance, by selecting at least two specific wavelengths from the specific wavelengths of 1,2,3,4,7,8-HxCDF (hexachlorodibenzofuran) shown in Table 2 and determining whether the selected specific wavelengths are shown in the specific wavelength spectrum of the sample obtained in the first step:

Table 9

1,2,3,4,7,8-HxCDF (hexachlorodibenzofuran)	
	Specific wavelength (nm)
1	320.49
2	319.94
3	319.68
4	319.04
5	318.11
6	317.63
7	317.28
8	316.97
9	316.81
10	316.36

14. A method of analyzing dioxins which identifies a dioxin isomer from a specific wavelength spectrum obtained by laser ionization mass spectrometry using supersonic jet/resonance-enhanced multiphoton ionization, the method comprising:

the first step of obtaining a specific wavelength spectrum of a sample by repeating the sequence of exciting the sample with a first laser light having a first wavelength, ionizing the excited sample with a second laser light having a second wavelength, and measuring the intensity of ion signals, while the first wavelength of the first laser light is varied step by step; and

the second step of identifying 1,2,3,6,7,8-HxCDF (hexachlorodibenzofuran) contained in the sample from the specific wavelength spectrum of the sample obtained in the first step and specific wavelengths of 1,2,3,6,7,8-HxCDF (hexachlorodibenzofuran) obtained in advance, by selecting at least two specific wavelengths from the specific wavelengths of 1,2,3,6,7,8-HxCDF (hexachlorodibenzofuran) shown in Table 2 and determining whether the selected specific wavelengths are shown in the specific wavelength spectrum of the sample obtained in the first step:

Table 10

1,2,3,6,7,8-HxCDF (hexachlorodibenzofuran)	
	Specific wavelength (nm)
1	319.32
2	319.15
3	318.92
4	318.75
5	318.64
6	318.47
7	318.16
8	317.75
9	317.54
10	316.80
11	316.74
12	316.45

15. A method of analyzing dioxins which identifies a

dioxin isomer from a specific wavelength spectrum obtained by laser ionization mass spectrometry using supersonic jet/resonance-enhanced multiphoton ionization, the method comprising:

the first step of obtaining a specific wavelength spectrum of a sample by repeating the sequence of exciting the sample with a first laser light having a first wavelength, ionizing the excited sample with a second laser light having a second wavelength, and measuring the intensity of ion signals, while the first wavelength of the first laser light is varied step by step; and

the second step of identifying 2,3,4,6,7,8-HxCDF (hexachlorodibenzofuran) contained in the sample from the specific wavelength spectrum of the sample obtained in the first step and specific wavelengths of 2,3,4,6,7,8-HxCDF (hexachlorodibenzofuran) obtained in advance, by selecting at least two specific wavelengths from the specific wavelengths of 2,3,4,6,7,8-HxCDF (hexachlorodibenzofuran) shown in Table 2 and determining whether the selected specific wavelengths are shown in the specific wavelength spectrum of the sample obtained in the first step:

Table 11

2,3,4,6,7,8-HxCDF (hexachlorodibenzofuran)	
	Specific wavelength (nm)
1	322.77
2	321.03
3	320.42
4	319.21
5	318.75
6	317.76

16. A method of analyzing dioxins which identifies a dioxin isomer from a specific wavelength spectrum obtained by laser ionization mass spectrometry using supersonic jet/resonance-enhanced multiphoton ionization, the method comprising:

the first step of obtaining a specific wavelength spectrum of a sample by repeating the sequence of exciting the sample with a first laser light having a first wavelength, ionizing the excited sample with a second laser light having a second wavelength, and measuring the intensity of ion signals, while the first wavelength of the first laser light is varied step by step; and

the second step of identifying 1,2,3,7,8,9-HxCDF (hexachlorodibenzofuran) contained in the sample from the specific wavelength spectrum of the sample obtained in the first step and specific wavelengths of 1,2,3,7,8,9-HxCDF

(hexachlorodibenzofuran) obtained in advance, by selecting at least two specific wavelengths from the specific wavelengths of 1,2,3,7,8,9-HxCDF (hexachlorodibenzofuran) shown in Table 2 and determining whether the selected specific wavelengths are shown in the specific wavelength spectrum of the sample obtained in the first step:

Table 12

1,2,3,7,8,9-HxCDF (hexachlorodibenzofuran)	
	Specific wavelength (nm)
1	323.44
2	322.71
3	320.19
4	317.03
5	316.55

17. A method of analyzing dioxins which identifies a dioxin isomer from a specific wavelength spectrum obtained by laser ionization mass spectrometry using supersonic jet/resonance-enhanced multiphoton ionization, the method comprising:

the first step of obtaining a specific wavelength spectrum of a sample by repeating the sequence of exciting the sample with a first laser light having a first wavelength, ionizing the excited sample with a second laser light having a second wavelength, and measuring the intensity of ion signals, while the first wavelength of the

first laser light is varied step by step; and

the second step of identifying 1,2,3,4,7,8,9-HpCDF (heptachlorodibenzofuran) contained in the sample from the specific wavelength spectrum of the sample obtained in the first step and specific wavelengths of 1,2,3,4,7,8,9-HpCDF (heptachlorodibenzofuran) obtained in advance, by selecting at least two specific wavelengths from the specific wavelengths of 1,2,3,4,7,8,9-HpCDF (heptachlorodibenzofuran) shown in Table 2 and determining whether the selected specific wavelengths are shown in the specific wavelength spectrum of the sample obtained in the first step:

Table 13

1,2,3,4,7,8,9-HpCDF (heptachlorodibenzofuran)	
	Specific wavelength (nm)
1	324.18
2	323.34
3	322.87
4	322.71
5	322.49
6	321.81
7	321.30
8	319.56
9	319.17
10	318.97

18. A method of analyzing dioxins which identifies a

dioxin isomer from a specific wavelength spectrum obtained by laser ionization mass spectrometry using supersonic jet/resonance-enhanced multiphoton ionization, the method comprising:

the first step of obtaining a specific wavelength spectrum of a sample by repeating the sequence of exciting the sample with a first laser light having a first wavelength, ionizing the excited sample with a second laser light having a second wavelength, and measuring the intensity of ion signals, while the first wavelength of the first laser light is varied step by step; and

the second step of identifying 1,2,3,4,6,7,8-HpCDF (heptachlorodibenzofuran) contained in the sample from the specific wavelength spectrum of the sample obtained in the first step and specific wavelengths of 1,2,3,4,6,7,8-HpCDF (heptachlorodibenzofuran) obtained in advance, by selecting at least two specific wavelengths from the specific wavelengths of 1,2,3,4,6,7,8-HpCDF (heptachlorodibenzofuran) shown in Table 2 and determining whether the selected specific wavelengths are shown in the specific wavelength spectrum of the sample obtained in the first step:

Table 14

1,2,3,4,6,7,8-HpCDF (heptachlorodibenzofuran)	
	Specific wavelength (nm)
1	324.51
2	323.80
3	323.41
4	323.21
5	322.64
6	322.11
7	321.91
8	321.56
9	321.43
10	321.33